

a gas concentration sensor having a sensor element and an electrical connector for connection to a remote digital signal processor,

said sensor element including a pump cell and a sensor cell, the pump cell being made of a solid electrolyte body and a first and a second pump cell electrode, the first and second pump cell electrodes being responsive to application of voltage to disassociate and pump oxygen molecules contained in exhaust gases of an automotive engine to which said gas concentration sensor is exposed out of said gas concentration sensor, said sensor cell being made of a solid electrolyte body and a first and a second sensor cell electrode, the first and second sensor cell electrodes being responsive to application of voltage to disassociate at least one of NO<sub>x</sub> HC, and CO contained in the exhaust gases through the first sensor cell electrode to produce a current signal flowing through the solid electrolyte body as a function of concentration of the at least one of NO<sub>x</sub>, HC, and CO; and

a microcomputer disposed within said connector performing functions of a gas concentration determining, impedance measuring, and heater control, the gas concentration determining being functionally connected to the first and second sensor cell electrodes to process and analyze the current signal provided by said gas concentration sensor to output data as a function of the concentration of the at least one of HO<sub>x</sub>, HC, and CO to said remote digital signal processor through serial digital signal communication, the impedance measuring function measuring an impedance of the

sensor element of said gas concentration sensor, the heater control function controlling power supply to a heater which heats the sensor element based on the measured impedance.

~~17~~. 3. (Amended) A gas concentration measuring apparatus as in claim ~~15~~<sup>1</sup> wherein said gas concentration sensor has an expected minimum level of output current during normal sensing operation and further comprising:

a conductor electrically connecting said gas concentration sensor and said microcomputer for transmission of the current signal from said gas concentration sensor to said microcomputer,

said conductor having a length selected as a function of said expected minimum level of the current signal outputted from said gas concentration sensor.

~~18~~. 4. (Amended) A method for operating a gas concentration sensor having a sensor element and an electrical connector for connection to a remote digital signal processor, said sensor element including a pump cell and a sensor cell, the pump cell being made of a solid electrolyte body and a first and a second pump cell electrode, the first and second pump cell electrodes being responsive to application of voltage to disassociate and pump oxygen molecules contained in exhaust gases of an automotive engine to which said gas concentration sensor is exposed out of said gas concentration sensor, said sensor cell being made of a solid electrolyte body and a first and a second sensor cell electrode, the first and second sensor cell electrodes being responsive to

application of voltage to disassociate at least one of NO<sub>x</sub>, HC, and CO contained in the exhaust gases through the first sensor cell electrode to produce a current signal flowing through the solid electrolyte body as a function of concentration of the at least one of NO<sub>x</sub>, HC, and CO, said method comprising:

providing in said connector a microcomputer performing functions of gas concentration determining, impedance measuring, and heater control, the gas concentration determining being functionally connected to the first and second sensor cell electrodes to process and analyze the current signal provided by said gas concentration sensor to output data as a function of the concentration of the at least one of HO<sub>x</sub>, HC, and CO to said remote digital signal processor through serial digital signal communication, the impedance measuring function measuring an impedance of the sensor element of said gas concentration sensor, the heater control function controlling a power supply to a heater which heats the sensor element based on the measured impedance.

20.6. (Amended) A method as in claim 18<sup>4</sup> wherein said gas concentration sensor has an expected minimum level of output current during normal sensing operation and wherein a gas concentration measuring apparatus as a conductor electrically connects said gas concentration sensor and said microcomputer for transmission of the current signal from said gas concentration sensor to said microcomputer,

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said conductor having a length selected as a function of said expected minimum

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level of the current signal outputted from said gas concentration sensor.

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